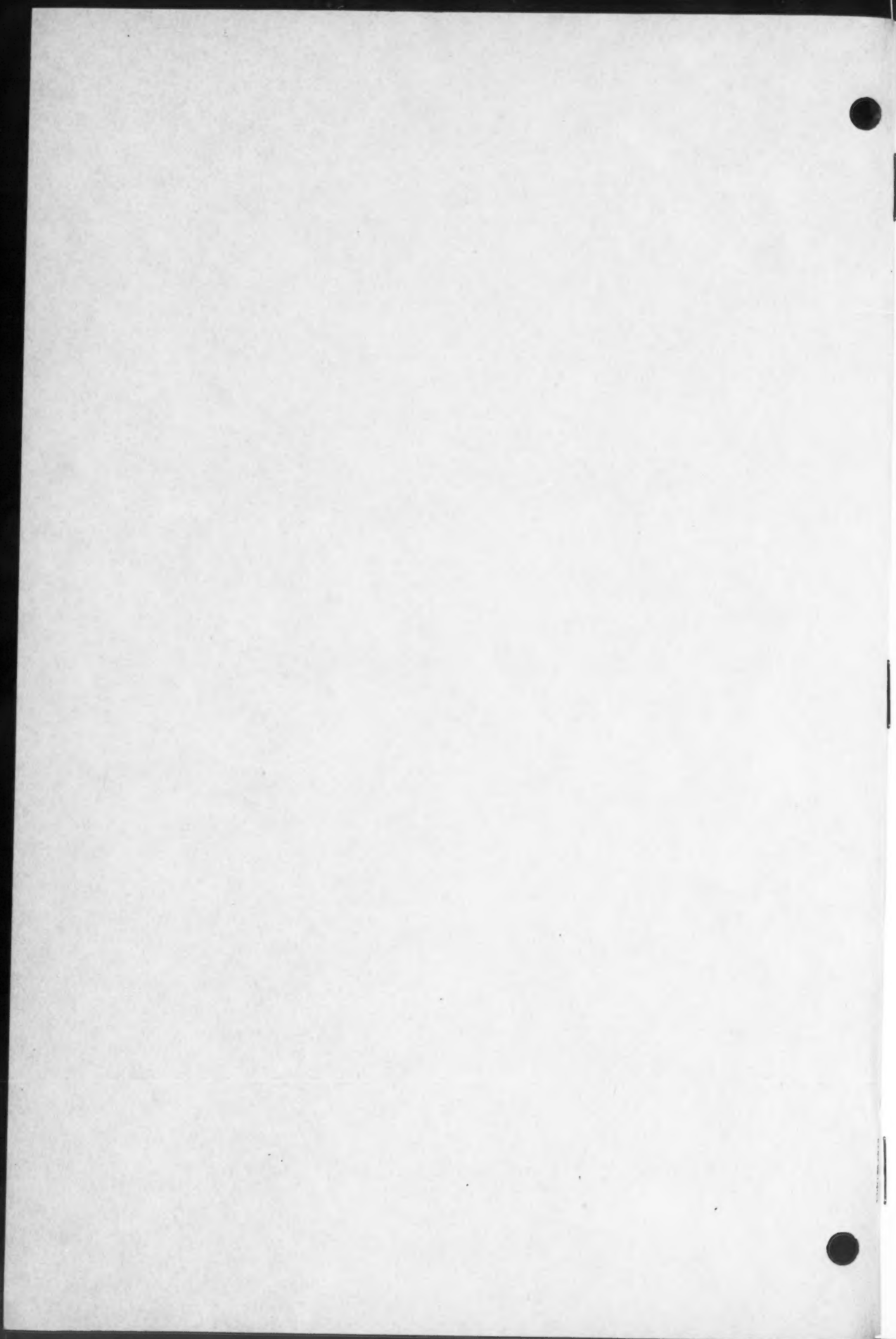


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REPRINTED FROM  
THE GEOGRAPHICAL REVIEW  
Volume XXXIX, No. 3, 1949  
Pages 425-439

AMERICAN GEOGRAPHICAL SOCIETY  
BROADWAY AT 156TH STREET  
NEW YORK



## "HIGH" AND "LOW" ISLANDS IN THE EASTERN CAROLINES

RAYMOND E. MURPHY

"HIGH" islands and "low" islands present the classic contrast of the South Seas. Although islands of moderate height have been formed in the tropical Pacific in several different ways, the contrast is likely to be best developed where mountainous masses of volcanic origin jut from the ocean to form the high islands. Atolls, their *motus* or individual islets barely rising above the waves, form the low islands. Associated with this difference in geomorphology are many other differences, both physical and human, an appreciation of which is fundamental to an understanding of the geography of the tropical Pacific.<sup>1</sup>

Robert Louis Stevenson stated the case when he wrote:

No distinction is so continually dwelt upon in South Sea talk as that between the "low" and the "high" island, and there is none more broadly marked in nature. . . . On the one hand, and chiefly in groups of from eight to a dozen, volcanic islands rise above the sea; . . . their tops are often obscured in cloud, they are all clothed with various forests, all abound in food, and are all remarkable for picturesque and solemn scenery. On the other hand, we have the atoll; . . . rudely annular in shape; enclosing a lagoon; rarely extending beyond a quarter of a mile at its chief width; often rising at its highest point to less than the stature of a man—man himself, the rat and the land crab, its chief inhabitants; not more variously supplied with plants; and offering to the eye, even when perfect, only a ring of glittering beach and verdant foliage, enclosing and enclosed by the blue sea.<sup>2</sup>

The paper here presented is a study of the contrasts as they were observed by the writer in the eastern Caroline Islands of the United States Trust Territory of the Pacific Islands. Field work was done in four distinct island groups. Ponape and Kusaie are high islands or island clusters; Mokil and Pingelap are atolls. As distances go in the Pacific, the four island groups are neighbors. Ponape, the westernmost, lies a little more than 300 miles west-northwest of Kusaie, the easternmost, and the north-south range of the four groups is only 120 miles. Substantial climatic differences rooted in latitude were therefore not in question, and fortunately there is a rough ethno-

<sup>1</sup> For a recent popular presentation of the contrast between high and low islands in Micronesia see Walter Karig: *The Fortunate Islands: A Pacific Interlude*, New York and Toronto, 1948, pp. 40-45. See also E. G. Burrows: *Topography and Culture on Two Polynesian Islands*, *Geogr. Rev.*, Vol. 28, 1938, pp. 214-223.

<sup>2</sup> Robert Louis Stevenson: *In the South Seas*, New York, 1896, p. 152.

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TABLE I—COMPARATIVE DATA FOR FOUR ISLAND UNITS

ISLANDS	MAXIMUM ELEVATION <i>In feet</i>	LAND AREA <i>In sq. mi.</i>	POPULATION		COPRA PRODUCTION		
			Jan. 1, 1948	<i>Per</i> <i>sq. mi.</i>	<i>year</i>	<i>In tons per</i> <i>sq. mi.</i>	<i>capita</i>
<i>High</i>							
Ponape★	2579	129.0	5735	44.5	2800	22.0	0.49
Kusaie	2079	42.3	1652	39.0	600	14.2	0.36
<i>Low</i>							
Pingelap	<20	0.7	685	978.0	100	143.0	0.15
Mokil	<20	0.5	449	898.0	80	160.0	0.18

\*Not including Ant and Pakin.

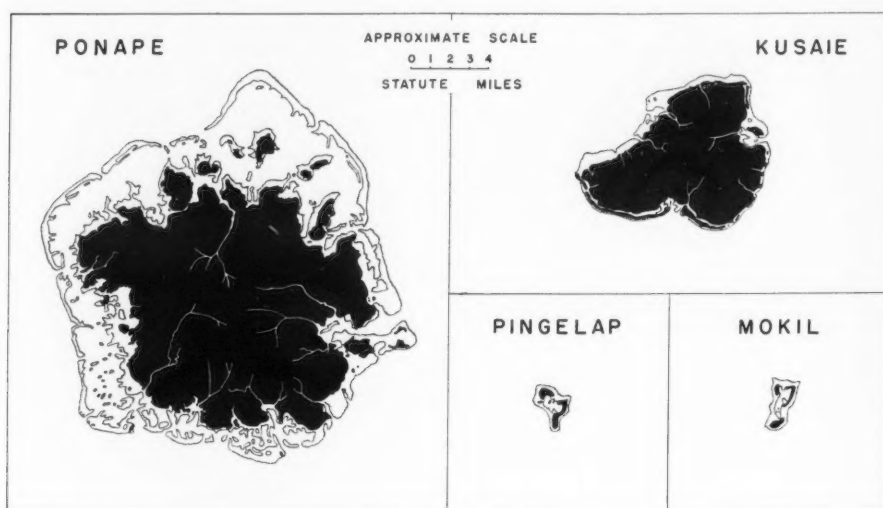


FIG. 1—Plan views of the four island groups on the same scale bring out striking contrasts (compare Table I).

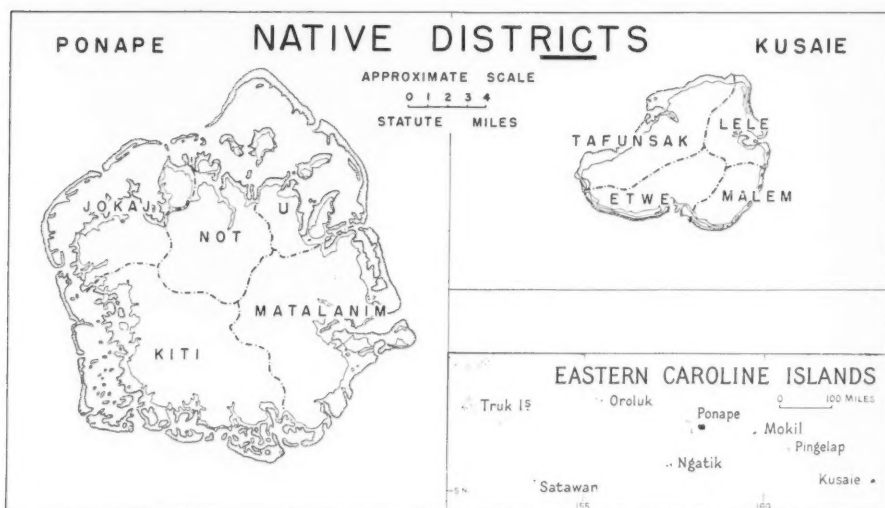


FIG. 2—Each of the two high islands has been divided traditionally into several districts. They are independent of one another in Ponape, but in Kusaie they acknowledge a single king.



FIGS. 3-5—Northern Ponape. Figure 3 (top), taken early in World War II, shows the village of Colony (Ponape) which was most entirely destroyed by bombing. Figure 4 (left) shows a gently rolling area in northwestern Ponape; it had been in use under Japanese but was waste land in 1947. Figure 5 (right) is the agricultural experiment station at the former village of Ponape. (Figs. 3 and 5 are official U. S. Navy photographs.)



graphic similarity. Attention, then, could be focused on the fundamental contrasts in the physical and human geography of the two types of islands.

#### PHYSICAL CONTRASTS

The high islands and the low present, in the first place, physical contrasts, contrasts that prevailed even in the distant past when the first canoe loads of people arrived.

The fundamental physical contrast is in landforms. The mountainous islands of Kusaie and Ponape rise in the interior to peaks higher than 2000 feet (Fig. 6 and Table I). In both, the bedrock consists chiefly of basaltic flows. There are small interior areas of relatively flat land, especially in Ponape, which have been interpreted as the remains of elevated marine terraces (Fig. 4).<sup>3</sup> Each island group has a peripheral coastal belt where land is level enough to be usable, and there are very small flood plains. But by far the greater part of the land is too steeply sloping for profitable use.

On the other hand, the islets that make up the atolls of Mokil and Pingelap are low and flat. The bedrock of coral limestone is covered with coral sand and loose fragments of coral. Since the elevation is nowhere greater than 20 feet, no land is unusable because of ruggedness.

The difference in soils is striking. Here the volcanic islands have the better of it. Their soils, though variable in quality and locally of little agricultural use because of basaltic rubble, are much more productive than anything the atolls have to offer. In fact, the atolls can hardly be said to have a real soil. Coral sand with a little organic matter forms the surface layers. Such material is extremely porous and, though suitable for a small variety of plants, will not support agriculture at all in the ordinary sense of the word.

Plan views bring out further contrasts reflecting origin (Fig. 1). The two high island groups have a compact, symmetrical shape. Each comprises one main island and several much smaller bordering fragments. Surrounding the main mass of each and separated from it by a lagoon is a barrier reef, broken by occasional channels. The lagoon is almost continuous and is used as a passageway for canoes and locally even for some small Diesel-powered motorboats or "pom-poms" that the natives inherited from the Japanese. Changes in sea level in geologically recent times drowned the mouths of the rivers, and the resulting estuaries, together with the channels through the reef maintained by the rivers, form good harbors.

<sup>3</sup> Josiah Bridge: *Mineral Resources of Micronesia* (Economic Survey of Micronesia, Vol. 3, Part 1), United States Commercial Company, Honolulu, 1946 (mimeographed), p. 95.

The two atolls consist of several islets roughly enclosing a lagoon.<sup>4</sup> A continuous coral platform surrounds each atoll (Fig. 10). It is not a barrier reef, and there is no channel through it. Mokil and Pingelap can be reached only by canoes and whaleboats, and the whaleboats, except at high tide, must be dragged part way across the reef.<sup>5</sup>

In part inherent in the differing origins of the high and low islands is the difference in size. Ponape is nearly 200 times, and Kusaie about 60 times, as large as Pingelap, the larger of the two atolls (Table I). In general, volcanic islands are fairly large.<sup>6</sup> Atolls, by their very nature, tend to be small; the largest in American Micronesia has a land area of only six or seven square miles, and the average is nearer one.

Climatic contrasts are less striking than land contrasts; nevertheless, some of them are sufficiently observable to be well known to the natives. The two volcanic islands have a higher average humidity<sup>7</sup> and receive considerably more precipitation than their lower neighbors. Records have been kept only for the volcanic islands, and even these records are far from satisfactory, but it is estimated that the average of 200 to 250 inches of rain a year is about twice that of the atolls. Moreover, the volcanic islands, because of their higher humidity, greater cloudiness, and greater rainfall, do not reach as high temperatures as the atolls—one of the contrasts of which the natives are aware.

Typhoons, fortunately, have been rare in the eastern Carolines. The last one recorded was in 1905. When typhoons have occurred, the low islands, lacking any real obstruction to wind and wave, have suffered more than their high neighbors. One must agree with the Pacific explorer Bougainville, who, upon contemplating the inhabitants of his first atoll, wrote:<sup>8</sup> "I admire their courage if they live without uneasiness on these strips of sand which a

<sup>4</sup> For a map of Mokil Atoll see Figure 1 in R. E. Murphy: *Landownership on a Micronesian Atoll*, *Geogr. Rev.*, Vol. 38, 1948, pp. 598-614.

<sup>5</sup> Not all atolls and volcanic islands of the tropical Pacific show this contrast. Some of the larger atolls of American Micronesia have sufficiently large and deep lagoons and deep enough passageways through the surrounding reef to permit effective use for harbors.

<sup>6</sup> Truk, which consists of a large number of small volcanic islands inside a reef, would seem to be an exception to this rule. But Truk may be regarded as intermediate between a volcanic island group and an atoll. Submergence has gone so far that only scattered remnants of volcanic peaks project above tide.

<sup>7</sup> The writer had ample opportunity to note the humidity contrast. During a several weeks' stay at the Military Government base in Ponape he had constantly to combat the dampness. Mold formed quickly on shoes and suitcases. Improvised "hot lockers," made by inserting an electric light into a bureau drawer, were a necessity. In Mokil, where the writer spent seven weeks, such measures were unnecessary, though of course they would have been impossible in any event, since no electricity was available.

<sup>8</sup> [Louis Antoine de Bougainville:] *Voyage autour du monde*, 2nd edit., 2 vols., Paris, 1772; reference in Vol. 2, p. 14.



FIG. 6—Kusaie looking northward from the south coast early in World War II. Note Port Lottin, one of the several harbors of the Kusaie coast; the barrier reef with its cover of coconut trees; and bordering it the mangrove-filled lagoon (dark belt). (Official U. S. Navy photograph.)



FIG. 7 (left)—*Cyrtosperma Chamissonis* (known as *mwäng* by the natives), the chief food crop of Mokil and Pingelap.



FIG. 8 (right)—A pandanus tree in Mokil. Even in a single atoll there are likely to be a number of varieties of pandanus.





FIG. 9—Northeastern Kusaie looking westward across Lele Island and Harbor, early in World War II. The Japanese had brought in Okinawans and natives from Ocean Island, Nauru, and the Gilbert and Ellice Islands to grow vegetables for them. The land cleared for this purpose is now overgrown with weeds and brush. (Official U. S. Navy photograph.)



FIG. 10—Coral platform on the east side of Kalap, Mokil; at a lower tidal stage the entire reef platform is exposed.

FIG. 11—Native sailing canoes in Mokil lagoon.

tempest can bury under water in the winking of an eye." There is a legend of a typhoon that nearly wiped out the peoples of Mokil and Pingelap.

Fresh water is relatively abundant on the two high islands. The bedrock is porous, and a large lens of fresh water rests on salt water.<sup>9</sup> Surface streams are numerous and are used for bathing and for washing clothes as well as for drinking water. On the atolls water other than collected rainfall is available only in wells and is often brackish. The statement has been made that on some atolls of Micronesia the natives get along with as little as a gallon of fresh water per capita a day in contrast with double that amount for the high islands and the 20 gallons used at American bases on the islands.

Mineral resources are unimportant in the eastern Carolines, though on the volcanic islands there are deposits large enough to have awakened interest. Bauxite, a normal end product of weathering of some kinds of igneous rock in the wet tropics, and several minor metals have been noted. But although prospecting was carried on by the Japanese, especially in Ponape, there has been no commercial mining,<sup>10</sup> nor does it seem likely. No mineral deposits of any conceivable value have ever been found in either Mokil or Pingelap.<sup>11</sup>

Two other contrasts in the physical attributes of the two types of islands should be mentioned. The high islands have a much greater variety, luxuriance, and density of plant life than the atolls, where poverty of soil and brackishness of ground water are limiting factors. Native animal life is scarce in the eastern Caroline Islands, but again the superiority of the high islands is evident. Birds are much greater in variety and number than on the atolls, and birds, wild pigs, and even deer (introduced by the Germans) are sometimes hunted in Ponape and Kusaie.

#### CULTURAL CONTRASTS IN THE PAST

The people of the two atolls have, in the first place, a background of greater intimacy with the sea than the high islanders. This is a contrast that extends far into the past. Nearly every family in Mokil, for example, has a record of ancestors coming from the Marshalls, from Pingelap, or from other atolls, but Ponape and Kusaie rarely appear in the records. For the last several generations at least, Ponapeans and Kusaicans seem to have found their own

<sup>9</sup> This is much the same situation that prevails in Oahu in the Hawaiian Islands. There it has been much studied because the ground water is critical to the existence of Honolulu and Pearl Harbor.

<sup>10</sup> Bridge, *op. cit.*, p. 97.

<sup>11</sup> On some neighboring atolls—for example, Ngatik, which lies 80 miles southwest of Ponape, and Ebon, in the southern Marshalls—small deposits of phosphate occur. But the fairly large deposits that have given distinction to Nauru and certain other Pacific islands occur on what are, essentially, "raised" coral islands rather than on true atolls, such as those of the eastern Carolines.

islands sufficient. Low islanders have migrated to the high islands, but there has been little movement in the reverse direction.

The difference in extent of seafaring activities may well have an explanation somewhat like this: The dweller on a high island found greater food-producing possibilities, and had more room to travel and trade, within the limits of his own island group. When he did travel by boat, he could often avoid the open sea by using the lagoons that, for long stretches, run parallel to the shores of the high islands. The atoll man, whose resources were much scantier, had a greater incentive to take to the sea, both for fish and for other foods and supplies to be had through trading with the people of other island groups. Even within the atoll he had to be constantly traveling from island to island by canoe.<sup>12</sup>

Explorers, whalers, and missionaries all seem to have been more interested in the high islands than in the atolls. To the whalers the supply of fresh water available was a primary consideration. Ponape became a famous outfitting center, and so, too, did Kusaie. Only limited stops appear to have been made at the atolls, though the considerable element of white blood apparent at the present time indicates that they were not entirely neglected. Missions were established in the two high island groups, but Christianization of their small neighbors was the work of native missionaries trained in Ponape or Kusaie. The larger size of the high islands, their greater productivity, their superior harbors, and their greater numbers of native people made them more attractive to whalers and missionaries alike.

The same considerations ruled the later history of the eastern Carolines. Ponape was a base for the Spaniards. In 1887 they established the village of Colony (Colonia de Santiago) on the north coast, and this village continued as an important administrative center under the Germans and the Japanese (Fig. 3). Kusaie, though distinctly secondary to Ponape, was also of interest to the Germans, but ordinarily no German official was to be found in Mokil. The Japanese maintained a sizable, growing colony in Ponape and a smaller one in Kusaie,<sup>13</sup> but Mokil had only one permanent Japanese resident, and he combined the functions of schoolteacher, trader, and dentist.

<sup>12</sup> Dr. Josiah Bridge of the United States Geological Survey, who has worked in Micronesia and who read an earlier version of this article, suggested an additional basis for the contrast in seafaring activities between the two types of islands, at least during the Japanese period. He pointed out that the Japanese strongly discouraged native fishing outside the reefs and that they discouraged interisland travel as well. As there were virtually no Japanese residents on the atolls, the prohibition against outside fishing may have been largely ignored there, but on the high islands the Japanese attitude must have tended to discourage interest in the sea.

<sup>13</sup> In the late 1930's Japanese slightly outnumbered the natives in Ponape, but there were probably not more than 30 or 40 Japanese in Kusaie.

The rise of the copra industry emphasized the differences between the two types of islands. The two volcanic groups, being much larger, naturally had a much greater total copra yield. Moreover, since the high islands were not as crowded, it was possible to introduce plantation cultivation in addition to the ordinary native production.<sup>14</sup>

In the years before World War II certain nonagricultural activities had developed in Ponape and Kusaie, but particularly in Ponape, in which the natives had little part. Commercial fishing was in the hands of Japanese using Okinawan labor. There was some small-scale manufacturing in Ponape, including fish processing, papermaking, the making of starch from cassava and of alcohol from sugar cane, lumbering, soapmaking, ice making, cotton weaving, and cigarette making. Sawmills were operated in Kusaie, and a few minor industries developed.<sup>15</sup> On both the high islands electric power plants were in operation. But none of these activities was in native hands. The two atolls, with only native populations and without the resources for modern industry, had no part in such developments, but they did share in the rising handicraft trade.

In World War II the atolls of the eastern Carolines had an advantage. They were too small to be of interest to the Japanese, either for producing food or as defense bases.<sup>16</sup> They had, it is true, to furnish young men to work in Ponape, but the atolls themselves were never given serious attention. Both Ponape and Kusaie were fortified and were heavily bombed. The atolls, however, suffered chiefly from neglect. Their people, long accustomed to clothing and supplies from the outside world, had to rely entirely on themselves for the war period.

At the close of the war the high islands, particularly Ponape, faced new problems. The banishment of the Japanese had left much vacant land whose

<sup>14</sup> Not all atolls are as densely peopled as Mokil and Pingelap, though such congestion seems to be usual. Some small atolls have no population and are put to no regular use. A few atolls were purchased or otherwise acquired by the ruling government or by some private concern at some time in the past and have been kept as copra plantations operated by the government or privately under some sort of concession. Ant and Pakin, two atolls a few miles west of Ponape, are of this general type. Ant is considered to be part of the Kiti District of Ponape; Pakin, a part of the Jokaj District of Ponape. Both have substantial coconut plantations that, in Japanese time, were operated from their respective Ponapean districts much as if the atolls were part of the Ponapean group. Indeed, they are sometimes grouped with Ponape under a single name, the Senyavin Islands.

<sup>15</sup> See the U. S. Navy Department's Civil Affairs Handbook "East Caroline Islands," OPNAV P22-5, 1944, p. 139. See also the mimeographed report by W. R. Bascom: Ponape: A Pacific Economy in Transition (Economic Survey of Micronesia, Vol. 8), United States Commercial Company, Honolulu, 1946, pp. 68-70.

<sup>16</sup> Some of the larger atolls elsewhere were less fortunate in these respects. Eniwetok, for example, was an important Japanese base and was in considerable part denuded by bombing.

ownership was in question. A considerable change in internal government was necessary. A temporary United States Military Government office was established in Kusaie, but Ponape, with a more commodious harbor that makes a reasonably good seaplane landing, was selected for a more permanent Island Governments base. On the atolls, which had been relatively undisturbed by the Japanese, life went on with little change, except for the problem of reestablishing natives who had been forced to work for the Japanese in Ponape during the war.

#### CONTRASTS IN PRESENT-DAY AGRICULTURE

The greatest present-day cultural contrasts between the two island types are in their agriculture. Between 40 and 45 species of wild and cultivated plants are used for food by the natives of Ponape;<sup>17</sup> the list for the atolls would probably not total more than 15. The greater variety of crops in the high islands doubtless reflects in part a richer original flora; but even more it represents introductions by missionaries, Spaniards, Germans, and Japanese. Most of the new crops were not well suited to the atolls, or they would doubtless have been passed on to the small islands, but limitations of space may have been another factor that kept them out. The wide possibilities of commercial agriculture in Ponape were recognized by the Germans, and later by the Japanese, who had plans for completely colonizing Ponape with their own people. They had planted considerable areas of the best land with crops of little interest to the natives. The atolls, on the other hand, since they offered slight opportunity for the development of new crops, had an agriculture that was little different from that of pre-Japanese days. The greater agricultural possibilities of the high islands permits an easier life for those for whom sheer subsistence is enough. The atoll natives say that life is easier on the high islands, but, they add, they like the atoll climate better.

Breadfruit is the chief food crop on the high islands of the eastern Carolines but is only moderately important on the atolls. Yams rank second to breadfruit in Ponape and are important in Kusaie, but they are not grown in Mokil and Pingelap. Sweet potatoes, introduced by the Japanese, and pineapples (Fig. 5), which are especially fine in Ponape and Kusaie, are not grown at all on the atolls. Although the low islands have several varieties of bananas, the high islands have many more, the best of which will not grow on the atolls; the papaya, too, is more at home in Ponape and Kusaie than on the low islands. Cassava has long been cultivated in Ponape and was an important crop under the Japanese in both Ponape and Kusaie. Now pro-

<sup>17</sup> Bascom, *op. cit.*, p. 5.



duction has declined because of lack of interest on the part of the natives; but cassava was never raised on the atolls. Corn is another crop that has found some favor on the high islands but is not known in Mokil or Pingelap. These are only a few of the host of plants that grow well on the volcanic islands but not at all or only poorly on the atolls.

Related to this circumstance is the striking dependence of the atolls on taro, especially *Cyrtosperma*.<sup>18</sup> The only truly cultivated crop, taro depends on an artificial soil that the islanders have carefully built up by piling leaves and other organic refuse in depressions, most of which appear to have been excavated in the distant past. These taro swamps have long been of vital importance in the lives of the atoll dwellers, and *Cyrtosperma* is unquestionably their "boss" food crop. *Cyrtosperma* is grown also on the high islands, but although these islands have natural taro swamps along fresh-water streams, the crop is of much less relative importance there.

The coconut tree is important in both types of islands but is more at home on the atolls. It is said to grow more rapidly in Mokil and Pingelap than in Ponape or Kusaie and to yield more nuts to a tree;<sup>19</sup> Moreover, less effort is required to keep weeds under control on the atolls, as compared with the rank growth of the high islands. Copra production on the atolls is entirely from small native holdings, whereas on the high islands several large plantations supplement the yield from native farms.

Analysis of copra production data for the four island groups is of particular interest (Table I). As would be expected, total yields are much larger for the high islands. On the other hand, the high proportion of rugged interior land there is reflected in considerably lower ratios of production to total land area. Most significant is the per capita production, which is considerably larger for the high island groups.<sup>20</sup> This ratio may be regarded as an index of prosperity in the eastern Carolines, since coconuts are the only cash crop of any importance. The low ratio for the atolls reflects their overpopulation and the resulting marginal existence of their inhabitants as far as purchasing power is concerned.

*Pandanus* is another crop that seems to thrive better on the atolls (Fig. 8). It is present in greater variety and is much more extensively used as thatching

<sup>18</sup> The name "taro" is often popularly applied to *Cyrtosperma Chamissonis* as well as to true taro, *Colocasia esculenta*, which is considerably less important on the atolls but is generally grown in the same swampy areas. For convenience of reference the popular usage is followed here.

<sup>19</sup> Bascom, *op. cit.*, p. 182.

<sup>20</sup> Ponape is even better off in copra production per capita than its ratio would suggest, since Ant and Pakin, which were excluded from the computations for Table I, consist largely of coconut plantations that are operated from Ponape (see footnote 14).

material, as food, and in handicrafts.<sup>21</sup> Arrowroot (*Tacca Leontopetaloides*), too, is much commoner in the atolls. The starch is used in various food combinations, but such use is rare in Ponape or Kusaie except where atoll natives have settled.

By way of summary it may be pointed out that much of the vegetation on the motus of the tropical Pacific consists of types that can tolerate a certain amount of brackish water. This is the case with the coconut, and also with pandanus. The papaya does not tolerate brackish water well and hence on the atolls, except in the most favored locations, is likely to have yellow leaves and other indications of unthriftiness. Taro is another crop that is somewhat intolerant of brackish water. Where motus are large enough, taro swamps are maintained in the interior without difficulty, but where the motus are too narrow and low, they may be unable to support a taro swamp.

Livestock were fairly numerous in the eastern Carolines before World War II, but their numbers are now greatly reduced. Poultry and swine, depending chiefly on coconuts and food refuse, were kept on both types of islands, but cattle were restricted to Ponape and Kusaie. It is unlikely that cattle will ever be raised on the atolls in view of the virtual impossibility of producing suitable feed for them.

#### SEAFARING TODAY

The atoll people still have greater contact with the sea than the people of Ponape and Kusaie. The picturesque canoe is not now used for long inter-island travels, but the people of Mokil make whaleboats and sail them to Ponape, a hundred miles away (Fig. 11). On the station ship that plies between the island groups about once a month, native travelers from the atolls outnumber those from more populous Kusaie and Ponape. The contrast is observable, too, in fishing. All the men of the atolls are fishermen, and they do much of their fishing in the open ocean, in contrast with the high islanders, who do not venture beyond the protecting reefs. The relative ease of native fishing in the lagoons of the high islands is reflected in the prominent role played by women; on the atolls, fishing is almost exclusively men's work. Bascom points out an interesting difference in the canoes commonly used by the Ponapeans and the atoll people.<sup>22</sup> Since Ponapean canoes seldom go beyond the barrier reef, they are built with an unusually shallow draft,

<sup>21</sup> The United States Commercial Company trader stationed in Ponape in the summer of 1947 told the writer that the best handicraft work (mats, fans, pocketbooks, etc.) though not the greatest quantity came from the atolls. He attributed the high quality of the products to greater availability of pandanus in the low islands and to better workmanship.

<sup>22</sup> Bascom, *op. cit.*, p. 7.

which permits them to pass over the reefs and coral heads that stud the lagoon. The atoll canoes, built for deeper water, can cross these obstacles only at high tide.

#### TRANSPORTATION AND EXTERNAL RELATIONS

Transportation on the volcanic islands presents problems notably different from those of the atolls. Since roads become muddy on the high islands, the better roads are built largely of basalt. Where the roads follow the coast, streams must be bridged, and maintenance of both bridges and roads is difficult. The Germans built roads in Ponape using basalt, and the practice was extended by the Japanese. Most of these are now in bad repair, and the island government must let them deteriorate still more or else embark on an expensive construction program. As a result, most present travel is by small boats in the lagoon. The two atolls have no need for good roads, since they have no vehicular travel. All paths are based directly on the coral sand with its cover of coral fragments, and drainage is so good that a natural roadbed is available anywhere.

In external connections the high islands have an advantage. Ponape, since it has an Island Governments unit, has regular ship connections with Guam and, through Guam, with the United States. Kusaie is less well served, but on each run the station ship from Ponape goes to Kusaie, though at times it may have to by-pass Mokil or Pingelap. Ponape also has seaplane service. The waters of the Trust Territory are now open to all nations for commercial fishing. There has been talk of a Hawaiian tuna-packing concern fishing in the eastern Caroline waters, and even of other private interests operating a trading ship. Ponape, and to a smaller extent Kusaie, may benefit from such developments, but it is unlikely that the atolls will be much affected. A post office may be opened at Ponape, and Ponape, because it has an Island Governments unit, has radio connections with the outside. The possibility of some regular radio communication with Kusaie has been considered. But no such installation seems practicable for the atolls.

#### CONTRASTS IN SOCIAL PATTERNS

In social organization, contrasts seem to be largely due to the greater populations and larger areas of the high islands.<sup>23</sup> For example, the clan

<sup>23</sup> W. R. Bascom, in an article entitled "Ponapean Prestige Economy" (*Southwestern Journ. of Anthropol.*, Vol. 4, 1948, pp. 211-221), points out an interesting complexity in the economic picture of Ponape. He distinguishes between subsistence economy, commercial economy, and prestige economy. The last is concerned with yams, pit breadfruit, kava, and pigs. For example, the Ponapean who contributes to a feast the largest yam or the oldest pit breadfruit gains a prestige that no amount of wealth could give him.

structure of Ponape, though found also in Mokil, is of little importance there. In native government the high islands are more complex. Ponape consists of five divisions or districts each of which is politically independent and has an elaborate structure of chiefs and subchiefs; Kusaie has four districts, but they acknowledge a single king (Fig. 2). The complicated native organizations of Ponape and Kusaie cause problems of modern government. Differences in faith add a further complication in Ponape; it is approximately half Roman Catholic and half Protestant, whereas the other three island groups are entirely Protestant (Congregational).

Although the high islands have considerably larger population totals, the atolls have much greater average population densities (Table I), even on the basis of usable land. Why is the population density so much lower in the high island groups? In part the very fact that the outside world was more attracted to the high islands proved their undoing. Introduced diseases not only took a toll of lives directly but, of even greater consequence, affected the birth rate through increasing sterility. A rather anomalous situation has resulted. The atolls, though not as productive in many respects as the high islands, furnished a dependable, relatively healthy existence and are now badly overcrowded. The two high islands, presenting relatively easy living conditions, have surprisingly low population densities.

The population-density contrast is reflected in turn in a land problem. Overcrowding on the low islands has reached such a level that every bit of land is owned and the buying and selling of land have long been forbidden.<sup>24</sup> But on the high islands there is much usable land available for settlement, and there have been no restrictions against its sale or purchase. Ponape is better off in this respect. In recent years the population of Kusaie has been recovering rapidly. Its percentage increase since 1920 has been higher than that of any of the other three island groups. This increase combined with a more rugged topography than that of Ponape means that Kusaie does not offer as great immigration possibilities. Still, compared with the two atolls, Kusaie is a land "flowing with milk and honey."

The high islands, therefore, offer the chief opportunities for future development. Mokil and Pingelap have reached their limits; they will be areas of ever increasing emigration. Planning the future so as best to promote the welfare of the native peoples of both high islands and atolls presents one of the most challenging problems facing the United States in the eastern Carolines.

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<sup>24</sup> For a detailed study of the manner in which land is owned and inherited in Mokil see Murphy *op. cit.*